

REMARKS

Claims 29 and 30 have been amended. New dependent claims 31 and 32 have been added. No new matter has been added to the application by virtue of the present amendment.

Accordingly, claims 29-32 are pending in the subject application. It is respectfully requested that the pending claims be reconsidered in view of this response.

Claim Rejections -- 35 U.S.C. 112, second paragraph

The Examiner rejected claims 29 and 30 under 35 U.S.C. 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 29 and 30, Applicants have made appropriate corrections to the claims.

Therefore, Applicants believe that the rejections under 35 U.S.C. 112, second paragraph have been overcome.

Claim Rejections -- 35 U.S.C. 103(a)

The Examiner rejected claims 29 and 30 under 35 U.S.C. 103(a) as being unpatentable over Mravic et al. (U.S. Patent No. 6,083,840); and, claims 29 and 30 under 35 U.S.C. 103(a) as being unpatentable over either Kaufman et al. (U.S. Patent No. 6,217,416 B1) and Kaufman et al. (U.S. Patent No. 6,063,306).

Applicants have amended independent claim 29 to more clearly distinguish Applicants' method over Mravic et al., Kaufman et al. ('416) and Kaufman et al. ('306). Claims 30-32 are dependent upon claim 29, as amended. Applicants' have amended claim 29 to include the limitations of "... a first slurry comprising an oxidizing agent consisting of a metal-based compound ..." and "... said second slurry for removing said barrier layer or liner at a first removal rate and copper at a second removal rate, wherein the first removal rate is greater than the second removal rate."

Mravic et al. neither teach nor suggest Applicants' limitation of removing the barrier layer or liner at a higher rate than the removal of copper. Mravic et al. teach a Cu/Ta/SiO₂ slurry composition "for polishing copper, copper adhesion promoting layers and silicon-based layers at approximately equal polishing rates ..." (column 7, lines 44-47; Abstract). Mravic et al. report removal rates of 143.5 nm/min for copper, 85.4 nm/min for tantalum and 146.2 nm/min for silicon dioxide (column 9, lines 58-60). Thus, Mravic et al. teach a barrier layer or liner removal

rate (tantalum) which is actually **less than** a copper removal rate.

Kaufman et al. ('416) and Kaufman et al. ('306) teach away from using a metal-based compound in the first slurry that is used for removing copper selective to the barrier layer or liner. Both Kaufman et al. ('416) and Kaufman et al. ('306) teach that "the use of an acid or base that contains **no metal ions** ... are preferred to avoid introducing undesirable metal components into the first CMP slurry" (Kaufman et al. '416: column 7, lines 21-25; Kaufman et al. '306: column 7, lines 18-22). Kaufman et al. ('416) and Kaufman et al. ('306) have a concern with metallic contamination of the semiconductor substrate and thus avoid introducing metal-based components into the first CMP slurry. On the other hand, Applicants have determined that the use of an oxidizing agent consisting of a metal-based compound, such as ferric nitrate, in the first slurry for removal of copper enhances the copper removal rate so that a higher selectivity to the barrier layer or liner is obtained.

Therefore, Applicants believe that the rejections under 35 U.S.C. 103(a) have been overcome.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

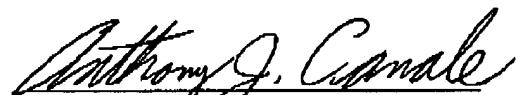
In light of the foregoing amendments and remarks, all of the claims now presented are believed to be in condition for allowance, and Applicants respectfully request that the outstanding rejections be withdrawn and this application be passed to issue at an early date.

The Examiner is urged to call the undersigned at the number listed below if, in the Examiner's opinion, such a phone conference would aid in furthering the prosecution of this application.

Respectfully Submitted,

For: Cote et al.

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VERSION WITH MARKINGS TO SHOW CHANGES MADEIn the claims:

29. (Once Amended) ~~The A~~ method of co-planarizing copper or copper-based metallurgy and a refractory metal-based barrier ~~layer~~ or liner in an interlevel dielectric ~~layer~~ of a semiconductor device comprising the steps of:

planarizing said copper or copper-based metallurgy using a first slurry comprising an oxidizing agent comprising ferric nitrate consisting of a metal-based compound, an oxidation inhibitor, a surfactant and an abrasive comprising alumina in water; said first slurry having a pH of between 1.2 and 2.5 and said first slurry capable of for removing copper selectively with respect to said barrier layer or liner;

co-planarizing said barrier layer or liner and said interlevel dielectric ~~layer~~ using a second slurry comprising a peroxide agent, an oxidation inhibitor, a surfactant and an abrasive comprising silica in water; said second slurry having a pH of between 3.0 and 7.5 and said second slurry capable of for removing said barrier layer or liner at a first removal rate and copper at a second removal rate, wherein the first removal rate is greater than the second removal rate.

30. (Once Amended) The method of claim 29 wherein said surfactant in both the first and second slurries comprises a sulfated fatty acid.

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